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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-055752

(43)Date of publication of application : 27.02.1996

(51)Int.Cl.

H01G 2/06

H01G 4/30

H05K 1/18

(21)Application number : 06-188184

(71)Applicant : TAIYO YUDEN CO LTD

(22)Date of filing : 10.08.1994

(72)Inventor : KOGA MASAKAZU

MURAI SHUNJI

FUJII OSAMU

KURATA SADA AKI

ISHIDA SHINICHI

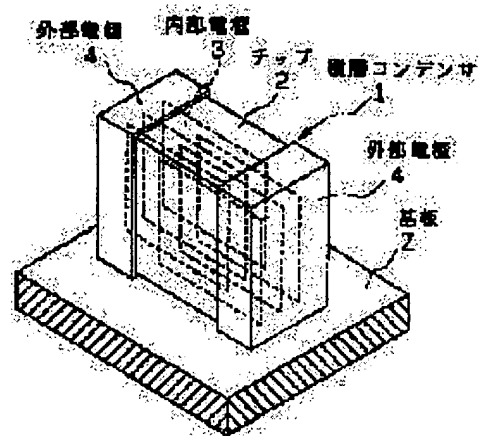
TAKAHASHI MINORU

(54) METHOD FOR MOUNTING LAYERED CAPACITOR AND LAYERED CAPACITOR

(57)Abstract:

PURPOSE: To provide a method for mounting a layered capacitor by which the volume of squeaking sounds can be reduced when a voltage is applied across the capacitor.

CONSTITUTION: Since a layered capacitor 1 in which internal electrodes 3 are faced to each other in a chip 2 is mounted on a substrate Z so that the surfaces of the electrodes 3 cannot become parallel to the surface of the substrate Z, the vibration of the electrodes 3 is not transmitted directly to the substrate Z even when the electrodes 3 vibrate in the facing direction of the electrodes 3 when a voltage is applied across the electrodes 3 and the amount of squeaking sounds can be reduced by suppressing the transmission of the vibrations to the substrate Z.



LEGAL STATUS

[Date of request for examination]	14.10.1997
[Date of sending the examiner's decision of rejection]	18.07.2000
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	abandonment
[Date of final disposal for application]	20.09.2002
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2000-12626

[Date of requesting appeal against examiner's decision 10.08.2000
of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The mounting method of the multilayer capacitor characterized by what the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip was mounted for so that the field of an internal electrode might become a substrate side and the sense [parallel].

[Claim 2] The mounting method of the multilayer capacitor characterized by what the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip was contained in the crevice of a part receipt tape, and the multilayer capacitor was contained for in the crevice of a part receipt tape with the sense from which the field of an internal electrode becomes perpendicular in the mounting method of the multilayer capacitor which takes this out from a tape and was made to mount in the substrate.

[Claim 3] The multilayer capacitor which carries out opposite arrangement of two or more internal electrodes into a chip, and is characterized by what was made in agreement [the opposite direction of an internal electrode] with the direction to which an external electrode is connected in the multilayer capacitor which prepared the external electrode in chip both ends.

[Claim 4] The multilayer capacitor characterized by what opposite arrangement of two or more internal electrodes was carried out, and the field of an internal electrode and the real wearing side [**** / un-] were formed for in the multilayer capacitor which prepared the external electrode in chip both ends at the external electrode in the chip.

[Claim 5] The multilayer capacitor characterized by what opposite arrangement of two or more internal electrodes was carried out, sheathing was attached to the circumference of a chip in the multilayer capacitor which prepared the external electrode in chip both ends, and the field of an internal electrode and the real wearing side [**** / un-] were formed for in the chip at this sheathing.

[Claim 6] The multilayer capacitor characterized by what the case where it had the field of an internal electrode and a real wearing side [**** / un-] was established for in the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes, and prepared the external electrode to chip both ends in the chip.

[Claim 7] The multilayer capacitor according to claim 5 or 6 characterized by what oscillating absorptivity material was used for sheathing or the case for.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the mounting method of a multilayer capacitor and multilayer capacitor which come to carry out opposite arrangement of two or more internal electrodes into a chip.

[0002]

[Description of the Prior Art] The cross section is shown for the perspective diagram of the multilayer capacitor of this kind former in drawing 4 at drawing 3, respectively.

[0003] The multilayer capacitor 1 shown in this drawing consists of a chip 2 of the rectangular parallelepiped configuration which consists of a ceramic dielectric, two or more internal electrodes 3 laid underground in the chip 2, and an external electrode 4 of the couple prepared in the both ends of a chip 2, and has width of face w , predetermined thickness t , and predetermined length l .

[0004] Each constituted the shape of same rectangle, and an internal electrode 3 exposed one of them to the chip end face of an opposite side by turns, and has joined this exposure edge to the terminal electrode 4 while it is arranged so that each may face each other in parallel in the thickness direction. Moreover, from the end face of a chip longitudinal direction, each external electrode 4 attains to the 4 sides of this end-face periphery, and is formed.

[0005]

[Problem(s) to be Solved by the Invention] If it usually puts in another way so that the whole surface of the thickness direction may become a substrate side and parallel as shown in drawing 3 and drawing 4, the above-mentioned conventional multilayer capacitor 1 is mounted so that the field of an internal electrode 3 may become the upper surface of Substrate Z, and parallel.

[0006] However, when voltage and the direct current voltage especially superimposed on the alternating current component of the alternating voltage of an audible frequency range (about 20Hz - 20kHz) or an audible frequency range are impressed between the external electrodes 4 in the state of the above-mentioned mounting, by the piezoelectric phenomena, the chip 2 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction, and vibrates in it, and there is a trouble which this gets across to Substrate Z directly, and an allophone and the so-called squeal generate. By the capacitor itself, even if it is a slight vibration, when it gets across to Substrate Z, it will be amplified by the increase in a plane-of-vibration product, and audible level will be reached.

[0007] this invention was made in view of the above-mentioned trouble, and the place made into the purpose is to offer the mounting method of a multilayer capacitor and multilayer capacitor which can reduce the squeal volume at the time of voltage impression.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention of a claim 1 is characterized by mounting the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip so that the field of an internal electrode may become a substrate side and the sense [parallel].

[0009] Invention of a claim 2 is characterized by having contained the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip in the crevice of a part receipt tape, and containing a multilayer capacitor in the crevice of a part receipt tape with the sense from which the field of an internal electrode becomes perpendicular in the mounting method of the multilayer capacitor which takes this out from a tape and was made to mount in the substrate.

[0010] Invention of a claim 3 carries out opposite arrangement of two or more internal electrodes into a chip, and is characterized by making the opposite direction of an internal electrode in agreement with the direction to which an external electrode is connected in the multilayer capacitor which prepared the external electrode in chip both ends.

[0011] Invention of a claim 4 carries out opposite arrangement of two or more internal electrodes into a chip, and is

characterized by forming the field of an internal electrode, and a real wearing side [**** / un-] at an external electrode in the multilayer capacitor which prepared the external electrode in chip both ends.

[0012] Invention of a claim 5 is characterized by forming in a chip at this sheathing [**** / un-] that carries out opposite arrangement of two or more internal electrodes, attaches sheathing to the circumference of a chip in the multilayer capacitor which prepared the external electrode in chip both ends, and intersects the field of an internal electrode.

[0013] Invention of a claim 6 carries out opposite arrangement of two or more internal electrodes into a chip, and is characterized by establishing the case where it has the field of an internal electrode, and a real wearing side [**** / un-] in the multilayer capacitor which prepared the external electrode to chip both ends.

[0014] Invention of a claim 7 is characterized by using oscillating absorptivity material for sheathing or a case in the multilayer capacitor according to claim 5 or 6.

[0015]

[Function] In invention of a claim 1, even if it produces vibration in the opposite direction of an internal electrode when voltage is impressed since the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip is mounted so that the field of an internal electrode may become a substrate side and the sense [parallel], this vibration does not get across to a substrate directly.

[0016] By invention of a claim 2, since the multilayer capacitor is contained in the crevice of a part receipt tape with the sense from which the field of an internal electrode becomes perpendicular, the field of an internal electrode surely becomes the perpendicular sense to a substrate side at the time of mounting, and direction regulation of the multilayer capacitor to the above substrate sides can be performed in the stage which takes out a multilayer capacitor from a part receipt tape.

[0017] In invention of a claim 3, since the opposite direction of an internal electrode is made in agreement with the direction to which an external electrode is connected, the field of an internal electrode surely becomes the perpendicular sense to a substrate side at the time of mounting. Therefore, when voltage is impressed, even if it produces vibration in the opposite direction of an internal electrode, this vibration does not get across to a substrate directly.

[0018] In invention of a claim 4, since the field of an internal electrode and the real wearing side [**** / un-] are formed in the external electrode, the field of an internal electrode surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when voltage is impressed, even if it produces vibration in the opposite direction of an internal electrode, this vibration does not get across to a substrate directly.

[0019] In invention of a claim 5, since sheathing is attached to the circumference of a chip and the field of an internal electrode and the real wearing side [**** / un-] are formed in this sheathing, the field of an internal electrode surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when voltage is impressed, even if it produces vibration in the opposite direction of an internal electrode, this vibration does not get across to a substrate directly.

[0020] In invention of a claim 6, since the case where it has the field of an internal electrode and a real wearing side [**** / un-] is established, the field of an internal electrode surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when voltage is impressed, even if it produces vibration in the opposite direction of an internal electrode, this vibration does not get across to a substrate directly.

[0021] By invention of a claim 7, since oscillating absorptivity material is used for sheathing or the case, vibration can be decreased in sheathing or the case itself. Other operations are the same as that of a claim 5 or invention of 6.

[0022]

[Example] The 1st example of this invention is shown in drawing 1 .

[0023] The multilayer capacitor 1 shown in this drawing consists of a chip 2 of the rectangular parallelepiped configuration which has the same structure as the conventional thing shown in drawing 3 and drawing 4 , namely, consists of a ceramic dielectric, two or more internal electrodes 3 laid underground in the chip 2, and an external electrode 4 of the couple prepared in the both ends of a chip 2.

[0024] Each constituted the shape of same rectangle, and an internal electrode 3 exposed one of them to the chip end face of an opposite side by turns, and has joined this exposure edge to the terminal electrode 4 while it is arranged so that each may face each other in parallel in the thickness direction. Moreover, from the end face of a chip longitudinal direction, each external electrode 4 attains to the 4 sides of this end-face periphery, and is formed.

[0025] this example is what mounted the multilayer capacitor 1 so that the field of an internal electrode 3 may become the upper surface and the perpendicular sense of Substrate Z, it lays a multilayer capacitor 1 in the upper surface of Substrate Z so that a handstand may be done in the cross direction, and it has soldered the unilateral side of each external electrode 4 in contact with the conductor pattern on Substrate Z (illustration ellipsis).

[0026] That is, since the field of an internal electrode 4 serves as a substrate side and perpendicular sense in the state of above-mentioned mounting When the direct current voltage superimposed on the alternating current component of the alternating voltage of an audible frequency range or an audible frequency range between the external electrodes 4 is impressed, even if the chip 2 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction and vibrates in it by the piezoelectric phenomena This vibration cannot get across to Substrate Z directly, the oscillating transfer to Substrate Z can be suppressed, and squeal volume can be reduced.

[0027] When width-of-face t , thickness, and length l made the sample the 1-micro F multilayer capacitor of F property by 2.5mm, 1.6mm, and 3.2mm, respectively, impressed alternating voltage to this and incidentally measured the volume of a squeal with the precision integration noise meter (the product made from the Ono meter, LA-500), the volume of the squeal which was 71dB was able to be reduced to 62dB with the mounting sense of drawing 1 with drawing 3 and the mounting sense of drawing 4 .

[0028] Since the above-mentioned multilayer capacitor has the part receipt tape T Ta, i.e., many crevices, as shown in drawing 2 , and this crevice Ta is contained on the part receipt tape T blockaded on the covering tape Ta and is dealt with in many cases If this multilayer capacitor 1 is contained with the sense from which the field of an internal electrode 3 becomes perpendicular in Crevice Ta beforehand, direction regulation of the multilayer capacitor 1 to the above substrate sides can be performed in the stage which takes out a multilayer capacitor 1 from Crevice Ta, removing the covering tape Ta.

[0029] The 2nd example of this invention is shown in drawing 5 and drawing 6 .

[0030] The multilayer capacitor 11 shown in this drawing consists of a chip 12 of the rectangular parallelepiped configuration which consists of a ceramic dielectric, two or more internal electrodes 13 laid underground in the chip 12, and an external electrode 14 of the couple prepared in the both ends of a chip 12.

[0031] Each constituted the shape of same rectangle, and an internal electrode 13 has joined one of them to drawer electrode 13a of the couple which exposes the end to each chip end face by turns while being arranged so that each may face each other in parallel in the length direction. Moreover, from the end face of a chip longitudinal direction, each external electrode 14 attained to the 4 sides of this end-face periphery, was formed, and is joined to the exposure edge of drawer electrode 13a.

[0032] Here, the manufacture method of the multilayer capacitor 11 of this example is explained. first, the dielectric green sheet which makes a barium titanate etc. a principal component -- metal mold -- the conductor which set the interval, formed the through hole train in the axial-symmetry form, and contained metal powders, such as Ag, by technique, such as punching and laser beam irradiation, -- while forming the rectangle-like internal electrode 13 using a paste so that the end section may lap with one through hole train by technique, such as screen-stencil, the through hole train of another side is also filled up with this paste, and a part of drawer electrode 13a is formed Moreover, the through hole train of 1 is formed in the same dielectric green sheet as the above by technique, such as golden closed-die-forging omission and laser beam irradiation, this through hole train is filled up with this paste, and a part of drawer electrode 13a is formed.

[0033] subsequently, a through hole train agrees the latter dielectric green sheet on a predetermined number-of-sheets pile and these both sides so that it may face each other, after the mutual through hole train agreed the former dielectric green sheet and the internal electrode has shifted by turns -- as -- putting -- being stuck by pressure -- this layered product -- a conductor -- it calcinates at the temperature corresponding to the metal component of a paste Each actual dielectric green sheet has the size which corresponded for taking a large number, and is cut by the part size after a laminating and sticking by pressure. subsequently, the edge by the side of drawer electrode exposure of the chip after baking -- the 4 sides of an end face to this end-face periphery -- reaching -- the same conductor as the above -- a paste is applied by technique, such as the dipping method, this is printed at low temperature rather than burning temperature, and the external electrode 14 is formed

[0034] In the multilayer capacitor 11 of this example, since the opposite direction of an internal electrode 13 is made in agreement with the direction to which the external electrode 14 is connected, the field of an internal electrode 13 surely becomes the perpendicular sense to a substrate side at the time of mounting. Therefore, when the direct current voltage superimposed on the alternating current component of the alternating voltage of an audible frequency range or an audible frequency range between the external electrodes 14 is impressed, even if the chip 12 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction and vibrates in it by the piezoelectric phenomena, this vibration cannot get across to Substrate Z directly, the oscillating transfer to Substrate Z can be suppressed, and squeal volume can be reduced.

[0035] When width-of-face t , thickness, and length l applicable to the 2nd example made the sample the 1-micro F multilayer capacitor of F property by 2.5mm, 1.6mm, and 3.2mm, respectively, impressed alternating voltage to this and incidentally measured the volume of a squeal like the above, the volume of a squeal was able to be reduced on the

almost same level as the 1st example.

[0036] The 3rd example of this invention is shown in drawing 7 and drawing 8.

[0037] The multilayer capacitor 21 shown in this drawing consists of a chip 22 of the rectangular parallelepiped configuration which consists of a ceramic dielectric, two or more internal electrodes 23 laid underground in the chip 22, and an external electrode 24 of the couple prepared in the both ends of a chip 22.

[0038] Each constituted the shape of same rectangle, and an internal electrode 23 has exposed one of them to the chip end face of an opposite side by turns while being arranged so that each may face each other in parallel in the thickness direction. Moreover, each external electrode 24 consisted of the closed-end rectangular pipe-like metal cap, it was attached in the both ends of a chip 22 with the side of this chip 22, and the 45-degree angle difference so that each ridgeline of a chip 22 might be located in the center of a medial surface, among those it has joined the base to the exposure edge of an internal electrode 23.

[0039] In the multilayer capacitor 21 of this example, since the field of an internal electrode 23 and the real wearing side with a 45-degree angle difference are formed in the external electrode 24, the field of an internal electrode 23 surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when the direct current voltage superimposed on the alternating current component of the alternating voltage of an audible frequency range or an audible frequency range between the external electrodes 24 is impressed, even if the chip 22 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction and vibrates in it by the piezoelectric phenomena, this vibration cannot get across to Substrate Z directly, the oscillating transfer to Substrate Z can be suppressed, and squeal volume can be reduced.

[0040] When width-of-face t , thickness, and length l applicable to the 3rd example made the sample the 1-micro F multilayer capacitor of F property by 2.5mm, 1.6mm, and 3.2mm, respectively, impressed alternating voltage to this and incidentally measured the volume of a squeal like the above, the volume of a squeal was able to be reduced on low level (59dB) rather than the 1st example.

[0041] In addition, the angle difference of the side of a chip 22 and the real wearing side of the external electrode 24 in the 3rd example can acquire the same effect, if not only 45 degrees but each is not parallel.

[0042] The 4th example of this invention is shown in drawing 9 and drawing 10.

[0043] The multilayer capacitor 31 shown in this drawing consists of a chip 32 of the rectangular parallelepiped configuration which consists of a ceramic dielectric, two or more internal electrodes 33 laid underground in the chip 32, and an external electrode 34 of the couple prepared in the both ends of a chip 32.

[0044] Each constituted the shape of same rectangle, and an internal electrode 33 exposed one of them to the chip end face of an opposite side by turns, and has joined this exposure edge to the terminal electrode 34 while it is arranged so that each may face each other in parallel in the thickness direction. Moreover, each external electrode 34 attains to the 4 sides of this end-face periphery from the end face of a chip longitudinal direction, and the whole is formed in the shape of a rectangle, and it has each side of a chip 32, and the field (real wearing side) with a 45-degree angle difference to the circumference.

[0045] In the multilayer capacitor 31 of this example, since the field of an internal electrode 33 and the real wearing side with a 45-degree angle difference are formed in the external electrode 34, the field of an internal electrode 33 surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when the direct current voltage superimposed on the alternating current component of the alternating voltage of an audible frequency range or an audible frequency range between the external electrodes 34 is impressed, even if the chip 32 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction and vibrates in it by the piezoelectric phenomena, this vibration cannot get across to Substrate Z directly, the oscillating transfer to Substrate Z can be suppressed, and squeal volume can be reduced.

[0046] When width-of-face t , thickness, and length l applicable to the 4th example made the sample the 1-micro F multilayer capacitor of F property by 2.5mm, 1.6mm, and 3.2mm, respectively, impressed alternating voltage to this and incidentally measured the volume of a squeal like the above, the volume of a squeal was able to be mostly reduced on this level with the 3rd example.

[0047] In addition, the angle difference of the side of a chip 32 and the real wearing side of the external electrode 34 in the 4th example can acquire the same effect, if not only 45 degrees but each is not parallel.

[0048] The 5th example of this invention is shown in drawing 11 and drawing 12.

[0049] The multilayer capacitor 41 shown in this drawing consists of the chip 42 of the rectangular parallelepiped configuration which consists of a ceramic dielectric, two or more internal electrodes 43 laid underground in the chip 42, an external electrode 44 of the couple prepared in the both ends of a chip 42, and resin sheathing 45 prepared in the circumference of a chip 42.

[0050] Each constituted the shape of same rectangle, and an internal electrode 43 exposed one of them to the chip end

face of an opposite side by turns, and has joined this exposure edge to the terminal electrode 44 while it is arranged so that each may face each other in parallel in the thickness direction. Moreover, from the end face of a chip longitudinal direction, each external electrode 34 attains to the 4 sides of this end-face periphery, and is formed. Furthermore, sheathing 45 has the rectangle-like appearance, is as flat-tapped as the ridgeline of the angle position of the external electrode 44, and has each side of a chip 42, and the field (real wearing side) with a 45-degree angle difference to the circumference.

[0051] In the multilayer capacitor 41 of this example, sheathing 45 is attached to the circumference of a chip 42, and since the field of an internal electrode 43 and the real wearing side with a 45-degree angle difference are formed in this sheathing 45, the field of an internal electrode 43 surely becomes the slanting sense to a substrate side at the time of mounting. Therefore, when the direct current voltage superimposed on the alternating current component of the alternating voltage of an audible frequency range or an audible frequency range between the external electrodes 44 is impressed, even if the chip 42 which consists of a ceramic dielectric repeats expansion and a return in the thickness direction and vibrates in it by the piezoelectric phenomena, this vibration cannot get across to Substrate Z directly, the oscillating transfer to Substrate Z can be suppressed, and squeal volume can be reduced.

[0052] When width-of-face t , thickness, and length l applicable to the 5th example made the sample the 1-micro F multilayer capacitor of F property by 2.5mm, 1.6mm, and 3.2mm, respectively, impressed alternating voltage to this and incidentally measured the volume of a squeal like the above, the volume of a squeal was able to be reduced on low level (56dB) rather than the 1st or 4th example.

[0053] In addition, the angle difference of the side of a chip 32 and the real wearing side of the external electrode 34 in the 4th example can acquire the same effect, if not only 45 degrees but each is not parallel. Moreover, if what was excellent in oscillating absorptivity as a material of sheathing 45, for example, an elasticity resin, rubber, etc. are used, vibration can be decreased by the sheathing itself and squeal volume can be reduced further. Furthermore, if the case of the case of this sheathing 45 and this appearance, the rectangular pipe which has the hole of the same type as the appearance of a chip 42, or a prismatic can also be substituted for the above-mentioned sheathing 45 and it uses the thing of oscillating absorptivity for a longitudinal direction end face as this case material in detail, it can decrease vibration in the case itself and can reduce squeal volume similarly.

[0054]

[Effect of the Invention] Even if it produces vibration in the opposite direction of an internal electrode when voltage is impressed since the multilayer capacitor which carried out opposite arrangement of two or more internal electrodes into the chip is mounted according to invention of a claim 1 so that the field of an internal electrode may become a substrate side and the sense [parallel] as explained in full detail above, this vibration cannot get across to a substrate directly, the oscillating transfer to a substrate can be suppressed, and squeal volume can be reduced.

[0055] Since the multilayer capacitor is contained in the crevice of a part receipt tape with the sense from which the field of an internal electrode becomes perpendicular according to invention of a claim 2, the field of an internal electrode surely becomes the perpendicular sense to a substrate side at the time of mounting, and there is an advantage which can perform direction regulation of the multilayer capacitor to the above substrate sides in the stage which takes out a multilayer capacitor from a part receipt tape.

[0056] Since the opposite direction of an internal electrode is made in agreement with the direction to which an external electrode is connected according to invention of a claim 3 When the field of an internal electrode surely becomes the perpendicular sense to a substrate side and voltage is impressed at the time of mounting, even if it produces vibration in the opposite direction of an internal electrode, this vibration cannot get across to a substrate directly, the oscillating transfer to a substrate can be suppressed like invention of a claim 1, and squeal volume can be reduced.

[0057] Since the field of an internal electrode and the real wearing side [**** / un-] are formed in the external electrode according to invention of a claim 4 When the field of an internal electrode surely becomes the slanting sense to a substrate side and voltage is impressed at the time of mounting, even if it produces vibration in the opposite direction of an internal electrode, this vibration cannot get across to a substrate directly, the oscillating transfer to a substrate can be suppressed like invention of a claim 1, and squeal volume can be reduced.

[0058] Since according to invention of a claim 5 sheathing is attached to the circumference of a chip and the field of an internal electrode and the real wearing side [**** / un-] are formed in this sheathing When the field of an internal electrode surely becomes the slanting sense to a substrate side and voltage is impressed at the time of mounting, even if it produces vibration in the opposite direction of an internal electrode, this vibration cannot get across to a substrate directly, the oscillating transfer to a substrate can be suppressed like invention of a claim 1, and squeal volume can be reduced.

[0059] Since the case where it has the field of an internal electrode and a real wearing side [**** / un-] is established

according to invention of a claim 6 When the field of an internal electrode surely becomes the slanting sense to a substrate side and voltage is impressed at the time of mounting, even if it produces vibration in the opposite direction of an internal electrode, this vibration cannot get across to a substrate directly, the oscillating transfer to a substrate can be suppressed like invention of a claim 1, and squeal volume can be reduced.

[0060] According to invention of a claim 7, since oscillating absorptivity material is used for sheathing or the case, vibration can be decreased in sheathing or the case itself, and squeal volume can be reduced further. Other effects are the same as that of a claim 5 or invention of 6.

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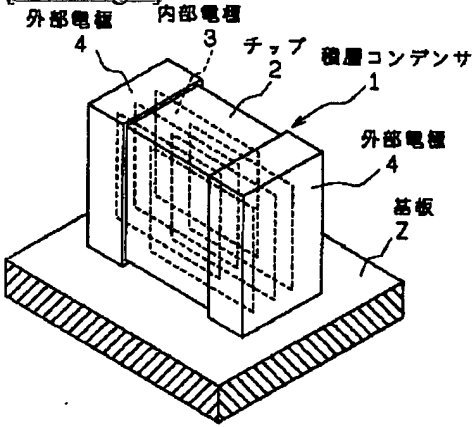
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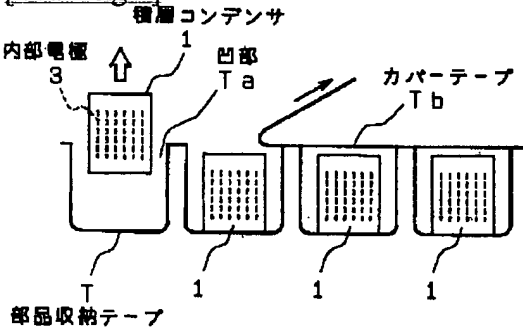
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DRAWINGS

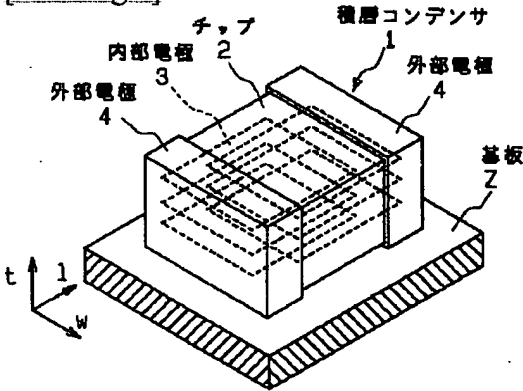
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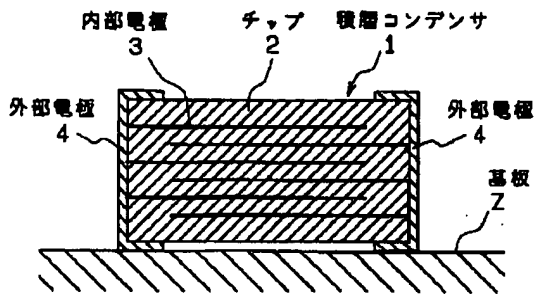
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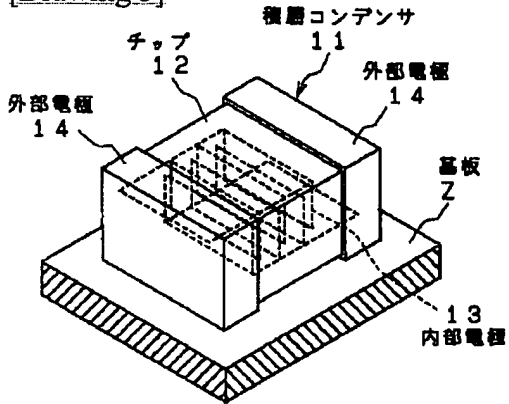
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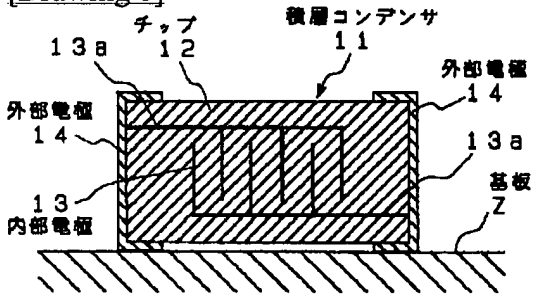
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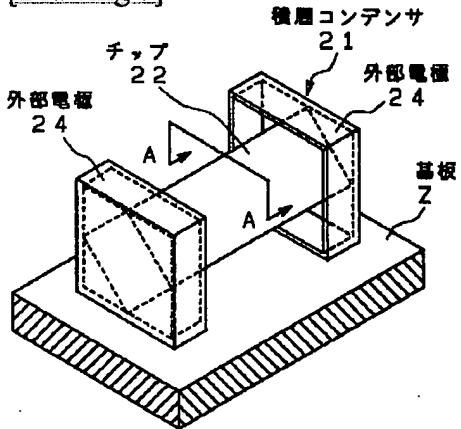
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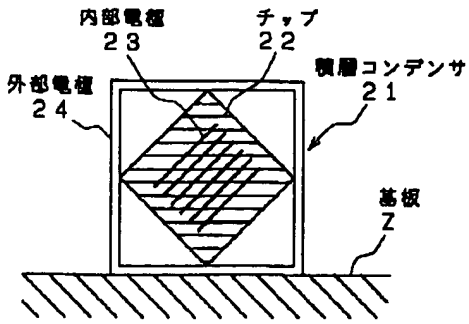
[Drawing 6]



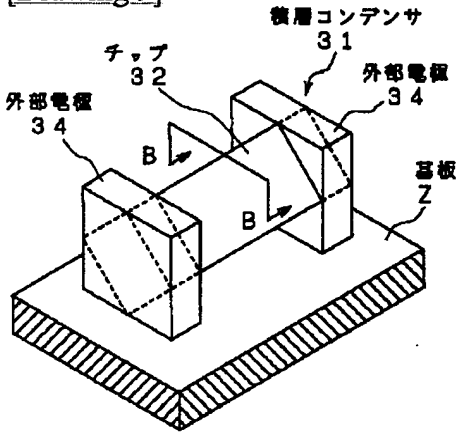
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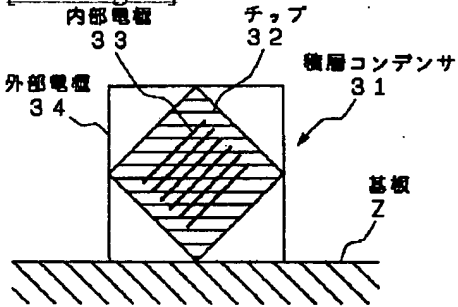
[Drawing 8]



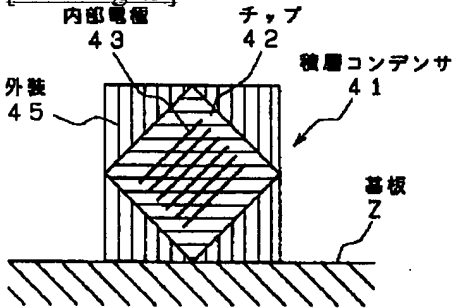
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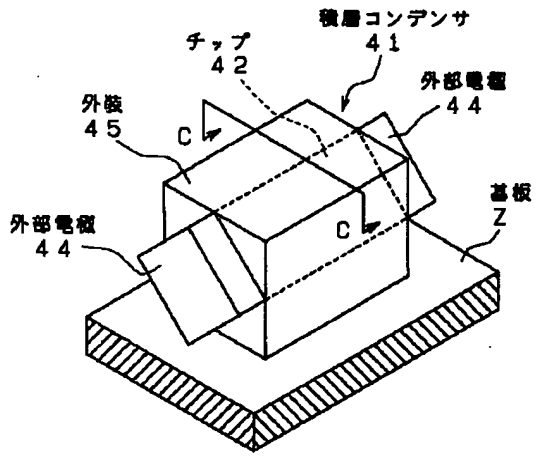
[Drawing 10]



[Drawing 12]



[Drawing 11]



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(19) 日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平 8 - 5 5 7 5 2

(43) 公開日 平成 8 年 (1996) 2 月 27 日

(51) Int. Cl. ⁶	識別記号	庁内整理番号	F I	技術表示箇所
H 0 1 G	2/06			
	4/30	3 0 1 Z	7924-5 E	
H 0 5 K	1/18	J	8718-4 E	
			9174-5 E	
			H 0 1 G	1/035 Z

審査請求 未請求 請求項の数 7 O L

(全 8 頁)

(21) 出願番号 特願平 6-188184

(22) 出願日 平成 6 年 (1994) 8 月 10 日

(71) 出願人 000204284

太陽誘電株式会社

東京都台東区上野 6 丁目 16 番 20 号

(72) 発明者 古賀 昌和

東京都台東区上野 6 丁目 16 番 20 号 太陽誘電株式会社内

(72) 発明者 村井 俊二

東京都台東区上野 6 丁目 16 番 20 号 太陽誘電株式会社内

(72) 発明者 藤井 理

東京都台東区上野 6 丁目 16 番 20 号 太陽誘電株式会社内

(74) 代理人 弁理士 吉田 精孝

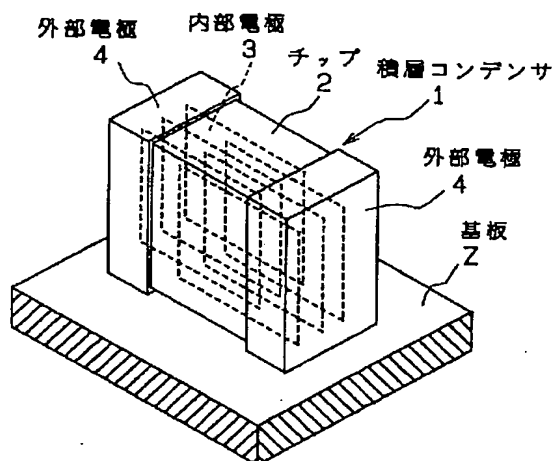
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(54) 【発明の名称】 積層コンデンサの実装方法及び積層コンデンサ

(57) 【要約】

【目的】 電圧印加時における鳴き音量を低減できる積層コンデンサの実装方法を提供すること。

【構成】 チップ 2 内に複数の内部電極 3 を対向配置した積層コンデンサ 1 を、内部電極 3 の面が基板 Z の面と非平行向きになるように実装してあるので、電圧を印加した際に内部電極 3 の対向方向に振動を生じても該振動が基板 Z に直接的に伝わることなく、基板 Z への振動伝達を抑制して鳴き音量を低減することができる。



【特許請求の範囲】

【請求項 1】 チップ内に複数の内部電極を対向配置した積層コンデンサを、内部電極の面が基板面と非平行向きになるように実装した、

ことを特徴とする積層コンデンサの実装方法。

【請求項 2】 チップ内に複数の内部電極を対向配置した積層コンデンサを部品収納テープの凹部内に収納し、これをテープから取り出して基板に実装するようにした積層コンデンサの実装方法において、

部品収納テープの凹部内に、積層コンデンサを内部電極の面が垂直となる向きで収納した、

ことを特徴とする積層コンデンサの実装方法。

【請求項 3】 チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、

内部電極の対向方向を外部電極を結ぶ方向と一致させた、

ことを特徴とする積層コンデンサ。

【請求項 4】 チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、

内部電極の面と非平行な実装用面を外部電極に形成した、

ことを特徴とする積層コンデンサ。

【請求項 5】 チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、

チップ周囲に外装を付設し、内部電極の面と非平行な実装用面を該外装に形成した、

ことを特徴とする積層コンデンサ。

【請求項 6】 チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、

内部電極の面と非平行な実装用面を有するケースを設けた、

ことを特徴とする積層コンデンサ。

【請求項 7】 外装又はケースに振動吸収性材料を用いた、

ことを特徴とする請求項 5 又は 6 記載の積層コンデンサ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、チップ内に複数の内部電極を対向配置してなる積層コンデンサの実装方法及び積層コンデンサに関するものである。

【0002】

【従来の技術】 図 3 にはこの種従来の積層コンデンサの斜視図を、図 4 にはその断面図を夫々示してある。

【0003】 同図に示した積層コンデンサ 1 は、セラミック誘電体から成る直方体形状のチップ 2 と、チップ 2

内に埋設された複数の内部電極 3 と、チップ 2 の両端部に設けられた一対の外部電極 4 とから構成され、所定の幅 w と厚み t と長さ l を有している。

【0004】 内部電極 3 は各々が同一の矩形状を成し、互いが厚み方向で平行に向き合うように配置されると共に、その一辺を交互に反対側のチップ端面に露出し、該露出端を端子電極 4 に接合している。また、各外部電極 4 はチップ長手方向の端面から該端面周縁の 4 側面に及んで形成されている。

【0005】

【発明が解決しようとする課題】 上記従来の積層コンデンサ 1 は、通常、図 3 及び図 4 に示すように、厚み方向の一面が基板面と平行になるように、換言すれば内部電極 3 の面が基板 Z の上面と平行になるように実装される。

【0006】 しかしながら、上記の実装状態で外部電極 4 間に電圧、とりわけ可聴周波数帯域（およそ 20 Hz ~ 20 kHz）の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加すると、セラミック誘電体から成るチップ 2 が圧電現象によって厚み方向に膨張、復帰を繰り返して振動し、これが基板 Z に直接的に伝わって異音、所謂鳴きが発生する問題点がある。コンデンサ自体では僅かな振動であっても、それが基板 Z に伝わると振動面積の増加により増幅されて可聴レベルに達することになる。

【0007】 本発明は上記問題点に鑑みてなされたもので、その目的とするところは、電圧印加時における鳴き音量を低減できる積層コンデンサの実装方法及び積層コンデンサを提供することにある。

【0008】

【課題を解決するための手段】 上記目的を達成するため、請求項 1 の発明は、チップ内に複数の内部電極を対向配置した積層コンデンサを、内部電極の面が基板面と非平行向きになるように実装したことを特徴としている。

【0009】 請求項 2 の発明は、チップ内に複数の内部電極を対向配置した積層コンデンサを部品収納テープの凹部内に収納し、これをテープから取り出して基板に実装するようにした積層コンデンサの実装方法において、部品収納テープの凹部内に、積層コンデンサを内部電極の面が垂直となる向きで収納したことを特徴としている。

【0010】 請求項 3 の発明は、チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、内部電極の対向方向を外部電極を結ぶ方向と一致させたことを特徴としている。

【0011】 請求項 4 の発明は、チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、内部電極の面と非平行な実装用面を外部電極に形成したことを特徴としている。

【0012】請求項5の発明は、チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、チップ周囲に外装を付設し、内部電極の面と交差する非平行な該外装に形成したことを特徴としている。

【0013】請求項6の発明は、チップ内に複数の内部電極を対向配置し、チップ両端部に外部電極を設けた積層コンデンサにおいて、内部電極の面と非平行な実装用面を有するケースを設けたことを特徴としている。

【0014】請求項7の発明は、請求項5又は6記載の積層コンデンサにおいて、外装又はケースに振動吸収性材料を用いたことを特徴としている。

【0015】

【作用】請求項1の発明では、チップ内に複数の内部電極を対向配置した積層コンデンサを、内部電極の面が基板面と非平行向きになるように実装しているので、電圧を印加した際に内部電極の対向方向に振動を生じても、該振動が基板に直接的に伝わることはない。

【0016】請求項2の発明では、部品収納テープの凹部内に、積層コンデンサを内部電極の面が垂直となる向きで収納してあるので、実装時において内部電極の面は基板面に対し必ず垂直向きになり、上述のような基板面に対する積層コンデンサの方向規制を部品収納テープから積層コンデンサを取り出す段階で行える。

【0017】請求項3の発明では、内部電極の対向方向を外部電極を結ぶ方向と一致させてあるので、実装時において内部電極の面は基板面に対し必ず垂直向きになる。従って、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることはない。

【0018】請求項4の発明では、内部電極の面と非平行な実装用面を外部電極に形成してあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになる。従って、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることはない。

【0019】請求項5の発明では、チップ周囲に外装を付設し、内部電極の面と非平行な実装用面を該外装に形成してあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになる。従って、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることはない。

【0020】請求項6の発明では、内部電極の面と非平行な実装用面を有するケースを設けてあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになる。従って、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることはない。

【0021】請求項7の発明では、外装又はケースに振動吸収性材料を用いてあるので、外装又はケース自体で

振動を減衰できる。他の作用は請求項5又は6の発明と同様である。

【0022】

【実施例】図1には本発明の第1実施例を示してある。

【0023】同図に示した積層コンデンサ1は図3及び図4に示した従来のものと同一構造を有しており、即ちセラミック誘電体から成る直方体形状のチップ2と、チップ2内に埋設された複数の内部電極3と、チップ2の両端部に設けられた一対の外部電極4とから構成されている。

【0024】内部電極3は各々が同一の矩形状を成し、互いが厚み方向で平行に向き合うように配置されると共に、その一辺を交互に反対側のチップ端面に露出し、該露出端を端子電極4に接合している。また、各外部電極4はチップ長手方向の端面から該端面周縁の4側面に及んで形成されている。

【0025】本実施例は、内部電極3の面が基板Zの上表面と垂直向きになるように積層コンデンサ1を実装したもので、積層コンデンサ1をその幅方向で倒立するように基板Zの上表面に載置し、基板Z上の導体パターン（図示省略）と接触する各外部電極4の一側面を半田付けしてある。

【0026】つまり、上述の実装状態では内部電極4の面が基板面と垂直向きとなるので、外部電極4間に可聴周波数帯域の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加したときにセラミック誘電体から成るチップ2が圧電現象によってその厚み方向に膨張、復帰を繰り返して振動しても、該振動が基板Zに直接的に伝わることなく、基板Zへの振動伝達を抑制して鳴き音量を低減することができる。

【0027】ちなみに、幅t、厚み及び長さlが夫々2.5mm、1.6mm、3.2mmでF特性の1 μ Fの積層コンデンサをサンプルとし、これに交流電圧を印加して鳴きの音量を精密積分騒音計（小野計器製、LA-500）にて測定したところ、図3及び図4の実装向きで71dBであった鳴きの音量を、図1の実装向きで62dBに低減することができた。

【0028】上記の積層コンデンサは図2に示すような部品収納テープT、即ち多数の凹部Taを有し該凹部TaをカバーテープTaで閉塞された部品収納テープTに収納し取り扱われる場合が多いので、該積層コンデンサ1を予め凹部Ta内に内部電極3の面が垂直となる向きで収納しておけば、カバーテープTaを剥しながら凹部Taから積層コンデンサ1を取り出す段階で上述のような基板面に対する積層コンデンサ1の方向規制を行うことができる。

【0029】図5及び図6には本発明の第2実施例を示してある。

【0030】同図に示した積層コンデンサ11は、セラミック誘電体から成る直方体形状のチップ12と、チッ

チップ 12 内に埋設された複数の内部電極 13 と、チップ 12 の両端部に設けられた一対の外部電極 14 とから構成されている。

【0031】内部電極 13 は各々が同一の矩形状を成し、互いが長さ方向で平行に向き合うように配置されると共に、チップ端面夫々にその一端を露出する一対の引出電極 13a にその一辺を交互に接合している。また、各外部電極 14 はチップ長手方向の端面から該端面周縁の 4 側面に及んで形成され、引出電極 13a の露出端に接合している。

【0032】ここで、本実施例の積層コンデンサ 11 の製造方法について説明する。まず、チタン酸バリウム等を主成分とする誘電体グリーンシートに金型打ち抜きやレーザ光照射等の手法によってスルーホール列を間隔をおき線対称形に形成し、Ag 等の金属粉末を含有した導体ペーストを用い、スクリーン印刷等の手法によって一方のスルーホール列にその一端部が重なるように矩形状の内部電極 13 を形成すると共に、他方のスルーホール列にも同ペーストを充填して引出電極 13a の一部を形成する。また、上記同様の誘電体グリーンシートに金型

打ち抜きやレーザ光照射等の手法によって一のスルーホール列を形成し、該スルーホール列に同ペーストを充填して引出電極 13a の一部を形成する。

【0033】次いで、前者の誘電体グリーンシートを互いのスルーホール列が合致し、且つ内部電極が交互にずれた状態で向き合うように所定枚数積み重ね、この両側に後者の誘電体グリーンシートをスルーホール列が合致するように積み重ねて圧着し、該積層体を導体ペーストの金属成分に対応した温度で焼成する。実際の各誘電体グリーンシートは多数個取りに対応した大きさを有して

おり、積層、圧着後に部品寸法に切断される。次いで、焼成後のチップの引出電極露出側の端部に端面から該端面周縁の 4 側面に及んで上記同様の導体ペーストをディップ法等の手法によって塗布し、これを焼成温度よりも低い温度で焼き付けて外部電極 14 を形成する。

【0034】本実施例の積層コンデンサ 11 では、内部電極 13 の対向方向を外部電極 14 を結ぶ方向と一致させてあるので、実装時において内部電極 13 の面は基板面に対し必ず垂直向きになる。従って、外部電極 14 間に可聴周波数帯域の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加したときにセラミック誘電体から成るチップ 12 が圧電現象によってその厚み方向に膨張、復帰を繰り返して振動しても、該振動が基板 Z に直接的に伝わることなく、基板 Z への振動伝達を抑制して鳴き音量を低減することができる。

【0035】ちなみに、第 2 実施例に該当する幅 t、厚み及び長さ l が夫々 2.5 mm、1.6 mm、3.2 mm で F 特性の 1 μ F の積層コンデンサをサンプルとし、これに交流電圧を印加して鳴きの音量を上記と同様に測定したところ、鳴きの音量を第 1 実施例とほぼ同じレベ

ルに低減することができた。

【0036】図 7 及び図 8 には本発明の第 3 実施例を示してある。

【0037】同図に示した積層コンデンサ 21 は、セラミック誘電体から成る直方体形状のチップ 22 と、チップ 22 内に埋設された複数の内部電極 23 と、チップ 22 の両端部に設けられた一対の外部電極 24 とから構成されている。

【0038】内部電極 23 は各々が同一の矩形状を成し、互いが厚み方向で平行に向き合うように配置されると共に、その一辺を交互に反対側のチップ端面に露出している。また、各外部電極 24 は有底角筒状の金属キャップから成り、チップ 22 の両端部に、チップ 22 の各稜線が内側面中央に位置するように該チップ 22 の側面と 45° の角度差をもって嵌着され、その内底面を内部電極 23 の露出端に接合している。

【0039】本実施例の積層コンデンサ 21 では、内部電極 23 の面と 45° の角度差をもつ実装用面を外部電極 24 に形成してあるので、実装時において内部電極 23 の面は基板面に対し必ず斜め向きになる。従って、外部電極 24 間に可聴周波数帯域の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加したときにセラミック誘電体から成るチップ 22 が圧電現象によってその厚み方向に膨張、復帰を繰り返して振動しても、該振動が基板 Z に直接的に伝わることなく、基板 Z への振動伝達を抑制して鳴き音量を低減することができる。

【0040】ちなみに、第 3 実施例に該当する幅 t、厚み及び長さ l が夫々 2.5 mm、1.6 mm、3.2 mm で F 特性の 1 μ F の積層コンデンサをサンプルとし、これに交流電圧を印加して鳴きの音量を上記と同様に測定したところ、鳴きの音量を第 1 実施例よりも低いレベル (59 dB) に低減することができた。

【0041】尚、第 3 実施例におけるチップ 22 の側面と外部電極 24 の実装用面との角度差は 45° に限らず、互いが非平行であれば同様の効果を得ることができる。

【0042】図 9 及び図 10 には本発明の第 4 実施例を示してある。

【0043】同図に示した積層コンデンサ 31 は、セラミック誘電体から成る直方体形状のチップ 32 と、チップ 32 内に埋設された複数の内部電極 33 と、チップ 32 の両端部に設けられた一対の外部電極 34 とから構成されている。

【0044】内部電極 33 は各々が同一の矩形状を成し、互いが厚み方向で平行に向き合うように配置されると共に、その一辺を交互に反対側のチップ端面に露出し、該露出端を端子電極 34 に接合している。また、各外部電極 34 はチップ長手方向の端面から該端面周縁の 4 側面に及んで全体が矩形状に形成され、チップ 32 の

各側面と 45° の角度差をもつ面（実装用面）をその周囲に有している。

【0045】本実施例の積層コンデンサ31では、内部電極33の面と 45° の角度差をもつ実装用面を外部電極34に形成してあるので、実装時において内部電極33の面は基板面に対し必ず斜め向きになる。従って、外部電極34間に可聴周波数帯域の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加したときにセラミック誘電体から成るチップ32が圧電現象によってその厚み方向に膨張、復帰を繰り返して振動しても、該振動が基板Zに直接的に伝わることなく、基板Zへの振動伝達を抑制して鳴き音量を低減することができる。

【0046】ちなみに、第4実施例に該当する幅 t 、厚み及び長さ l が夫々 2.5mm 、 1.6mm 、 3.2mm でF特性の $1\mu\text{F}$ の積層コンデンサをサンプルとし、これに交流電圧を印加して鳴きの音量を上記と同様に測定したところ、鳴きの音量を第3実施例とほぼ同レベルに低減することができた。

【0047】尚、第4実施例におけるチップ32の側面と外部電極34の実装用面との角度差は 45° に限らず、互いが非平行であれば同様の効果を得ることができる。

【0048】図11及び図12には本発明の第5実施例を示してある。

【0049】同図に示した積層コンデンサ41は、セラミック誘電体から成る直方体形状のチップ42と、チップ42内に埋設された複数の内部電極43と、チップ42の両端部に設けられた一対の外部電極44と、チップ42の周囲に設けられた樹脂外装45とから構成されている。

【0050】内部電極43は各々が同一の矩形状を成し、互いが厚み方向で平行に向き合うように配置されると共に、その一辺を交互に反対側のチップ端面に露出し、該露出端を端子電極44に接合している。また、各外部電極34はチップ長手方向の端面から該端面周縁の4側面に及んで形成されている。更に、外装45は矩形状の外形を有しており、外部電極44の角位置の稜線と面一で、且つチップ42の各側面と 45° の角度差をもつ面（実装用面）をその周囲に有している。

【0051】本実施例の積層コンデンサ41では、チップ42の周囲に外装45を付設し、内部電極43の面と 45° の角度差をもつ実装用面を該外装45に形成してあるので、実装時において内部電極43の面は基板面に対し必ず斜め向きになる。従って、外部電極44間に可聴周波数帯域の交流電圧や可聴周波数帯域の交流成分が重畳された直流電圧を印加したときにセラミック誘電体から成るチップ42が圧電現象によってその厚み方向に膨張、復帰を繰り返して振動しても、該振動が基板Zに直接的に伝わることなく、基板Zへの振動伝達を抑制

して鳴き音量を低減することができる。

【0052】ちなみに、第5実施例に該当する幅 t 、厚み及び長さ l が夫々 2.5mm 、 1.6mm 、 3.2mm でF特性の $1\mu\text{F}$ の積層コンデンサをサンプルとし、これに交流電圧を印加して鳴きの音量を上記と同様に測定したところ、鳴きの音量を第1乃至第4実施例よりも低いレベル（ 56dB ）に低減することができた。

【0053】尚、第4実施例におけるチップ32の側面と外部電極34の実装用面との角度差は 45° に限らず、互いが非平行であれば同様の効果を得ることができる。また、外装45の材料として振動吸収性に優れたものの、例えば軟質樹脂やゴム等を用いれば、外装自体で振動を減衰して鳴き音量をさらに低減することができる。更に、上記の外装45は該外装45と同外形のケース、詳しくは長手方向端面にチップ42の外形と同一形の孔を有する角筒又は角柱状のケースで代用することもでき、該ケース材料として振動吸収性のものを用いればケース自体で振動を減衰して鳴き音量を同様に低減することができる。

【0054】

【発明の効果】以上詳述したように、請求項1の発明によれば、チップ内に複数の内部電極を対向配置した積層コンデンサを、内部電極の面が基板面と非平行向きになるように実装しているため、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることなく、基板への振動伝達を抑制して鳴き音量を低減することができる。

【0055】請求項2の発明によれば、部品収納テープの凹部内に、積層コンデンサを内部電極の面が垂直となる向きで収納してあるので、実装時において内部電極の面は基板面に対し必ず垂直向きになり、上述のような基板面に対する積層コンデンサの方向規制を部品収納テープから積層コンデンサを取り出す段階で行える利点がある。

【0056】請求項3の発明によれば、内部電極の対向方向を外部電極を結ぶ方向と一致させてあるので、実装時において内部電極の面は基板面に対し必ず垂直向きになり、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることなく、請求項1の発明と同様に基板への振動伝達を抑制して鳴き音量を低減することができる。

【0057】請求項4の発明によれば、内部電極の面と非平行な実装用面を外部電極に形成してあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになり、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることなく、請求項1の発明と同様に基板への振動伝達を抑制して鳴き音量を低減することができる。

【0058】請求項5の発明によれば、チップ周囲に外装を付設し、内部電極の面と非平行な実装用面を該外装

に形成してあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになり、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることなく、請求項 1 の発明と同様に基板への振動伝達を抑制して鳴き音量を低減することができる。

【0059】請求項 6 の発明によれば、内部電極の面と非平行な実装用面を有するケースを設けてあるので、実装時において内部電極の面は基板面に対し必ず斜め向きになり、電圧を印加した際に内部電極の対向方向に振動を生じても該振動が基板に直接的に伝わることなく、請求項 1 の発明と同様に基板への振動伝達を抑制して鳴き音量を低減することができる。

【0060】請求項 7 の発明によれば、外装又はケースに振動吸収性材料を用いてあるので、外装又はケース自体で振動を減衰して鳴き音量をさらに低減することができる。他の効果は請求項 5 又は 6 の発明と同様である。

【図面の簡単な説明】

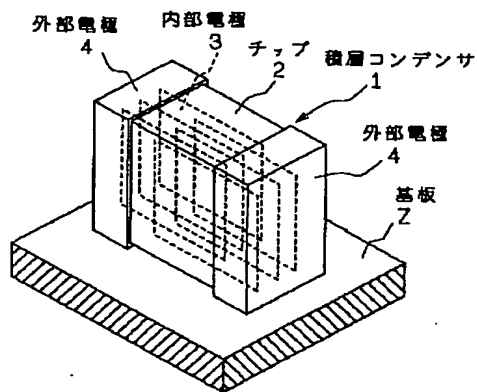
【図 1】本発明の第 1 実施例に係る積層コンデンサの実装斜視図

【図 2】部品収納テープを示す図

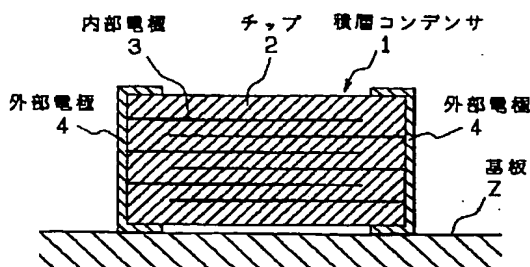
【図 3】従来例に係る積層コンデンサの実装斜視図

【図 4】図 3 に示した積層コンデンサの断面図

【図 1】



【図 4】



【図 5】本発明の第 2 実施例に係る積層コンデンサの斜視図

【図 6】図 5 に示した積層コンデンサの断面図

【図 7】本発明の第 3 実施例に係る積層コンデンサの斜視図

【図 8】図 7 に示した積層コンデンサの A-A 線断面図

【図 9】本発明の第 4 実施例に係る積層コンデンサの斜視図

【図 10】図 9 に示した積層コンデンサの B-B 線断面図

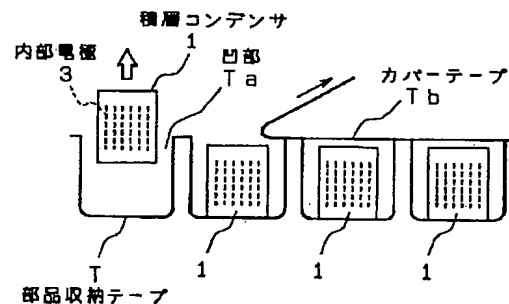
【図 11】本発明の第 5 実施例に係る積層コンデンサの斜視図

【図 12】図 11 に示した積層コンデンサの C-C 線断面図

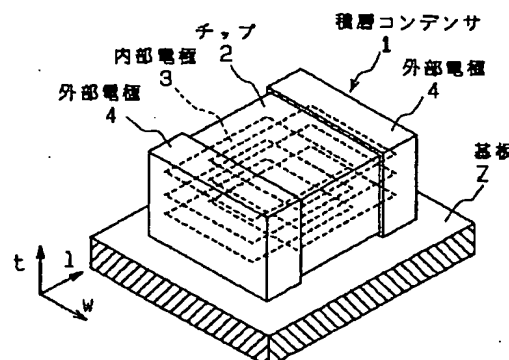
【符号の説明】

1…積層コンデンサ、2…チップ、3…内部電極、4…外部電極、Z…基板、T…部品収納テープ、Ta…凹部、11…積層コンデンサ、12…チップ、13…内部電極、14…外部電極、21…積層コンデンサ、22…チップ、23…内部電極、24…外部電極、31…積層コンデンサ、32…チップ、33…内部電極、34…外部電極、41…積層コンデンサ、42…チップ、43…内部電極、44…外部電極、45…外装。

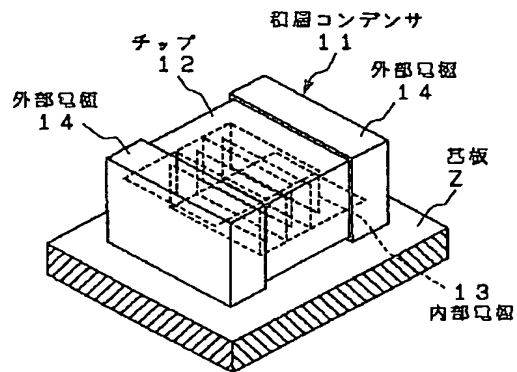
【図 2】



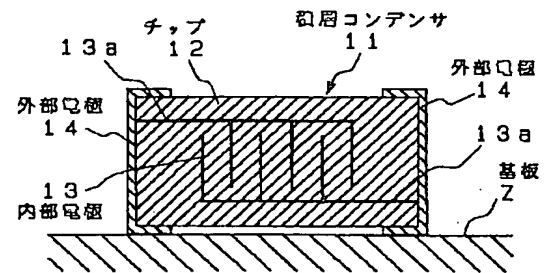
【図 3】



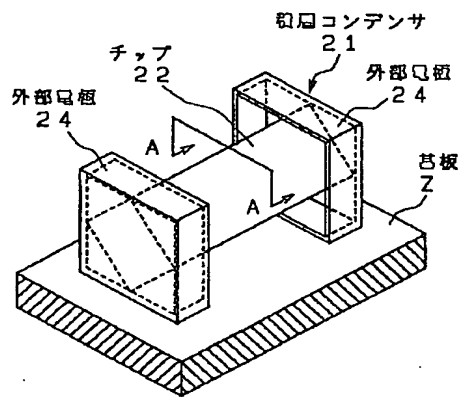
【図 5】



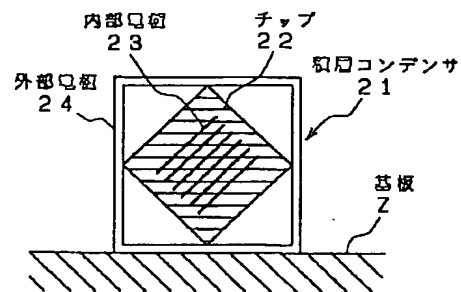
【図 6】



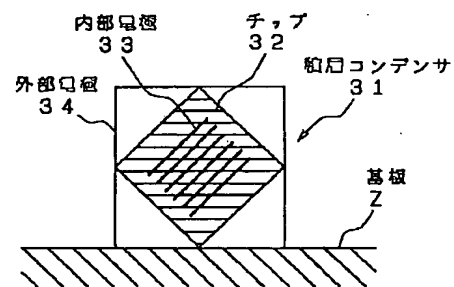
【図 7】



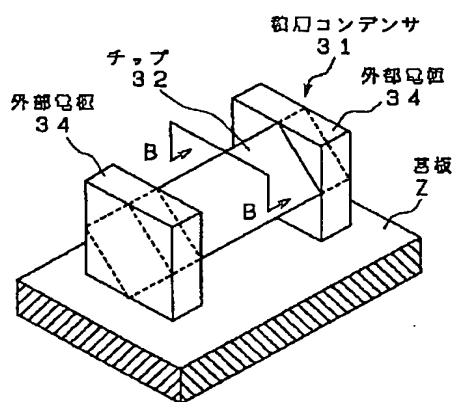
【図 8】



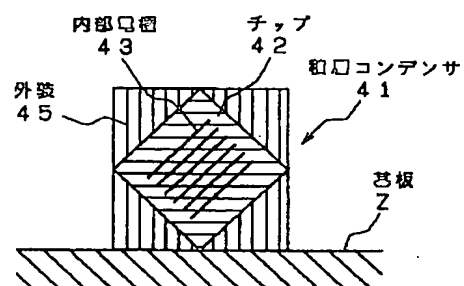
【図 10】



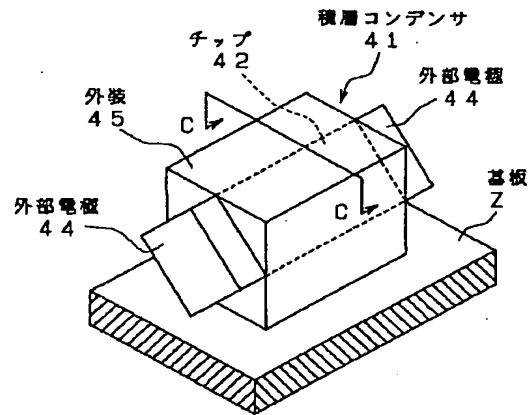
【図 9】



【図 12】



【図 11】



フロントページの続き

(72) 発明者 倉田 定明
 東京都台東区上野 6 丁目 16 番 20 号 太陽誘
 電株式会社内

(72) 発明者 石田 晋一
 東京都台東区上野 6 丁目 16 番 20 号 太陽誘
 電株式会社内

(72) 発明者 高橋 実
 東京都台東区上野 6 丁目 16 番 20 号 太陽誘
 電株式会社内